

if one were to depend on standard light trapping methods one would conclude that the moth is among the rarest lepidopterans in eastern North America. However if one employs bait or searches for caterpillars one could conclude just the opposite, that *L. joannis* is among the most common noctuids in Appalachian forests where its foodplant, *Aesculus flava*, grows in abundance.

Identification of the adults was confirmed by Eric Metzler. Vouchers of both larvae and adults have been deposited at the University of Connecticut; adults have also been deposited at the United States National Museum.

James Adams, Dale Schweitzer, and Bo Sullivan offered suggestions on an earlier draft of the paper and Rene Twarkins assisted with the larval images.

Journal of the Lepidopterists' Society
60(3), 2006, 176–178

DIURNAL HERBIVORY DOCUMENTED FOR *SPEYERIA IDALIA* (NYMPHALIDAE) LARVAE ON *VIOLA SAGITTATA* (VIOLACEAE) IN PENNSYLVANIA

Additional key words: regal fritillary, violet, foraging

Only two extant populations of the regal fritillary, *Speyeria idalia* Drury (Nymphalidae), are documented east of Indiana (Barton 1996 for Pennsylvania, Hobson 1999 and Chazal 2002 for Virginia). The larger of the two populations occurs inside National Guard Training Center-Fort Indiantown Gap (NGTC-FIG), an approximately 6,925-ha military base located in south-central Pennsylvania. Comprehensive descriptions of the old-field successional habitats occupied by *S. idalia* at NGTC-FIG are presented in Barton (1996) and TNC (2001). Morphologic and genetic evidence indicates that eastern populations may deserve specific or subspecific status and designation as an evolutionary significant unit (Williams 2001a, 2001b, 2002). In light of the conservation status of *S. idalia*, research is warranted on its life history.

Nocturnal foraging on *Viola* species has been reported or referenced for *S. idalia* larvae by Holland (1998), Ferris & Brown (1981), Opler & Krizek (1984), Schull (1987), Royer (1988), Ifner *et al.* (1992), Royer & Marrone (1992), and West (1998). However, Kopper *et al.* (2001) documented diurnal feeding on *V. pedatifida* G. Don (Violaceae) in three out of 12 *S. idalia* larvae observed in Kansas. At NGTC-FIG, Barton (1995) reported diurnal movements of *S. idalia* larvae and noted the predominance of *V. sagittata* Aiton relative to the presence of other *Viola* species but did not describe larval foraging behavior.

Because *S. idalia* larvae have been challenging to

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Received for publication 7 November 2005; revised and accepted 9 June 2006

locate in the field across the species' range (Scudder 1989 for New England, TNC 2001 for Pennsylvania, Kopper *et al.* 2001 for Kansas, Debinski pers. com. for Iowa), behavioral observations of larvae have been difficult to obtain (Kopper *et al.* 2001). A combination of factors such as low population density (Barton 1995), small body size, solitary distribution, cryptic coloration and behavior (Stamp & Wilkens 1993), high mortality rates (Mattoon *et al.* 1971, Wagner *et al.* 1997), and concealing vegetation may partially explain the modest numbers of field-documented larvae. Previous surveys conducted at NGTC-FIG to detect larvae have resulted in very small sample sizes ($n = 9$; Barton 1995) or failure ($n = 0$; TNC 2000, 2001).

On May 14, 2001, one *S. idalia* larva was unintentionally discovered at the Pennsylvania site during a vegetation study. Shortly thereafter, a qualitative survey of selected grasslands, known to be inhabited by *S. idalia* adults during previous years, was performed in an attempt to detect more larvae. Typically conducted between 0900 and 1600 hrs, the survey followed a generalized protocol: searching for individuals and groups of *V. sagittata* (including arrow- and ovate-leaved varieties), inspecting violets for evidence of strip-feeding herbivory (typical of *S. idalia*), and visually scanning violets and the surrounding area for larvae. Images of *S. idalia* larvae in Allen (1997) and Richard & Heitzman (1987) assisted with positive species identification.

TABLE 1. Spatio-temporal and behavioral data for *S. idalia* larvae observed at NGTC-FIG, Pennsylvania, May 2001. Spatial locations have been normalized by subtracting the coordinate values of the first sighting.

Individual larvae	Date	Time	Spatial location (UTM meters)		Behavior at time of discovery	Diurnal feeding on leaves of <i>V. sagittata</i>
			Northing	Eastings		
1	5/14	1200	0.0	0.0	motionless; on bare ground*	observed in field
2	5/18	0945	2617.3	5049.6	motionless; < 30 cm from <i>Viola</i>	observed in captivity
3	5/18	1102	2618.4	5047.5	motionless; on <i>Viola</i>	not observed
4	5/22	1200	361.8	72.5	motionless; on <i>Viola</i>	observed in captivity
5	5/24	1110	3557.5	6057.0	feeding on <i>Viola</i>	observed in field
6	5/25	1440	2705.6	5041.1	feeding on <i>Viola</i>	observed in field

*distance to nearest *Viola* was unrecorded for larva 1

Five additional *S. idalia* larvae were opportunistically discovered after more than 30 observer-hours of search effort (Table 1). Digital photographs were taken of each larva encountered and of the habitat in the immediate vicinity of each sighting. Spatial coordinates of larvae were determined through Global Positioning System (GPS) technology (hardware: Pro XR Trimble receiver unit and TSC1 Asset Surveyor Trimble datalogger; software: Pathfinder Office version 2.80) and expressed in Universal Transverse Mercator (UTM) meters. Larvae were not marked so as to avoid potential handling effects. Because newly and previously identified larvae were indistinguishable, duplication was possible but unlikely, due to the relatively long distances between sightings on preceding days [i.e., ~80 m (minimum), ~7000 m (maximum)]. The two larvae observed simultaneously on May 18 were separated by

approximately two meters.

Diurnal foraging on *V. sagittata* was documented in five of the six larvae observed (Table 1 and Figure 1), a strong trend despite the extremely small sample size. Similar to those reported in Kopper *et al.* (2001), feeding bouts were short-lived. *S. idalia* larvae were observed to consume only leaves of *V. sagittata*, either partially or completely. In addition to foliar herbivory, Beattie & Lyons (1975) and Kopper *et al.* (2001) reported floral consumption of *Viola* spp. by the larvae of *Argyannis* spp. and *S. idalia*, respectively. Such behaviors, as well as nocturnal foraging bouts, may have been exhibited by larvae at the NGTC-FIG site but were not observed. Nonetheless, given the observations presented here for Pennsylvania, in conjunction with those for Kansas by Kopper *et al.* (2001), diurnal foraging by *S. idalia* larvae may be more prevalent than

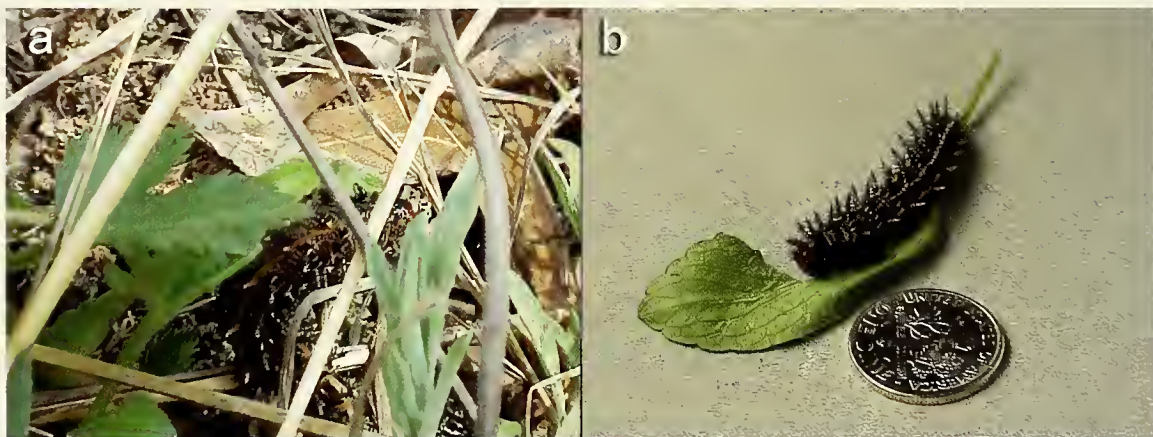


FIG. 1. Images of two *S. idalia* larvae diurnally foraging on *V. sagittata* in the field (a) and in controlled conditions (b) at NGTC-FIG, Pennsylvania, May 2001.

previously described in the scientific literature.

Drs. Brian Kopper and Barry Williams (University of Wisconsin), Dr. Roger Latham (Continental Conservation), and Joseph Hovis (Pennsylvania Department of Military and Veterans Affairs or DMVA) offered insightful comments on a preceding draft. John Emmett, NGTC-FIG GIS Analyst, provided the Trimble GPS receiver and datalogger for field use and assisted with geospatial data management. Special thanks go to the Pennsylvania Army National Guard (PAARNG) for granting access to field sites and vehicles for on-base transportation. This project was sponsored by the PAARNG (Cooperative Agreement # DAHA36-01-2-9001), and funding was provided by the Pennsylvania DMVA. The content of the information presented does not reflect the position or policy of the U.S. Government, and no official endorsement should be inferred.

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Received for publication 28 March 2003; revised and accepted 26 June 2006

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